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(54) **ESTABLISHING A CONNECTION TRAVERSING A NETWORK ADDRESS TRANSLATION GATEWAY**

EINRICHTUNG EINER VERBINDUNG, DIE EIN GATEWAY ZUR
NETZWERKADRESSENÜBERSETZUNG DURCHLÄUFT

ÉTABLISSEMENT D'UNE CONNEXION TRAVERSANT UNE PASSERELLE DE TRADUCTION
D'ADRESSES DE RÉSEAU

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(73) Proprietor: **Sling Media, Inc.
Foster City, CA 94404 (US)**

(72) Inventors:
• **Asnis, Ilya
San Jose, CA 95124 (US)**
• **Dham, Vikram
Fremont, CA 94555 (US)**

(74) Representative: **Beck Greener
Fulwood House
12 Fulwood Place
London WC1V 6HR (GB)**

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Description

[0001] The present invention relates to a method of establishing a connection traversing a network address translation gateway.

[0002] Network address translation (NAT) rewrites packet headers for the purpose of remapping a given IP address and/or ports. Many systems use network address translation to enable multiple hosts on a private network to access the Internet using a single public IP address. Network address translation obscures an internal networks structure. Traffic sent to and received from the Internet all appears to come from a single device.

[0003] Devices behind an NAT gateway may not have end to end connectivity. This may cause problems with some Internet protocols. Typically, incoming packets are prevented from reaching their destination on the internal network by the NAT gateway. Furthermore, NAT may interfere with tunneling protocols such as IPsec because NAT may modify values in the packet which cause integrity checks to fail.

[0004] However, NAT has become a popular method to address the limitation on the number of IPv4 addresses that are available. In particular, NAT is an indispensable function used extensively in routers for home and small office Internet connections. A common configuration has a local area network using a designated private IP address range (e.g., 192.1.x.x) connected to the Internet via a single public IP address. Document BOULTON ET AL: "Best Current Practices for NAT Traversal for SIP; draft-ietf-sipping-nat-scenarios-07.txt", IETF, 9 July 2007, XP015051703, discloses several best practices for NAT traversal for SIP.

[0005] Document ROSENBERG: "Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/ Answer Protocols; draft-ietf-mmusic-ice-19.txt", IETF, 29 October 2007, XP015058542, discloses the ICE protocol used for NAT traversal. It is an object of the present invention to provide a method of establishing a connection traversing at least one network address translation (NAT) gateway. The invention is defined by the appended claims. Embodiments of the present invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an illustration of a mediated network address translation traversal system;

Figure 2 is a flow diagram of a method of establishing a connection traversing at least one network address translation gateway;

Figure 3 is a flowchart of a source method of establishing a connection traversing at least one network address translation gateway;

Figure 4 is a flowchart of a destination method of

establishing a connection traversing at least one network address translation gateway;

Figure 5 is a flowchart of a mediation element method of establishing a connection traversing at least one network address translation gateway; and

Figure 6 is a block diagram of a computer system.

[0006] Figure 1 is an illustration of a mediated network address translation (NAT) traversal system (100). The NAT traversal system 100 comprises source device 110, destination device 111, mediation element 112, message server 113, network 120, NAT gateway 130, and NAT gateway 131. Source device 110 is operatively coupled to NAT gateway 130. NAT gateway 130 is operatively coupled to network 120. Destination device 111 is operatively coupled to NAT gateway 131. NAT gateway 131 is operatively coupled to network 120. Mediation element 112 is operatively coupled to network 120. Message server 113 is operatively coupled to network 120.

[0007] Network 120 may be any network or collection of networks that couple, link, or otherwise operatively connect NAT gateway 130, NAT gateway 131, mediation element 112, and/or message server 113. Network 120 may include other secondary data networks. In an example, network 120 may include a backhaul network, a local network, a long distance network, a packet network, the Internet, or any combination thereof, as well as other types of networks.

[0008] Source device 110 may be any device, system, combination of devices, or other such communication platform capable of communicating with network 120 via NAT gateway 130. Destination device 111 may be any device, system, combination of devices, or other such communication platform capable of communicating with network 120 via NAT gateway 130.

[0009] For example, source device 110 or destination device 111 may be, or comprise, for example, a computer, a mobile phone, a wireless phone, a wireless modem, a personal digital assistant (PDA), a voice over internet protocol (VoIP) phone, a voice over packet (VOP) phone, a soft phone, a media device, a network enabled television, a network enabled digital video recorder (DVR), or a Slingbox, as well as other types of devices or systems that can exchange data with network 120 via NAT gateway 130 or NAT gateway 131. Other types of communication platforms are possible.

[0010] NAT gateway 130 or NAT gateway 131 may be, or comprise, for example, a NAT configured router, switch, gateway, or computer. NAT gateway 130 or NAT gateway 131 may be configured to implement one or more of full cone NAT, (address) restricted cone NAT, port restricted cone NAT, or symmetric NAT. In addition, source device 110 and destination device 111 may be on the same local network, or may both use the same NAT gateway 130 or 131 to connect with network 120. In this case, (not shown) NAT gateway 130 and NAT

gateway 131 would be the same device. Other devices may also use NAT gateway 130 or NAT gateway 131 to connect to network 120, but these are not illustrated in Figure 1. Mediation element 112 or message server 113 may be, or comprise, for example, computer systems, servers, or other network connected elements.

[0011] Figure 2 is a flow diagram of a method of establishing a connection traversing at least one network address translation gateway. In Figure 2, message server 113 and destination device 111 maintain persistent communication with each other. Thus, message server 113 knows destination device 111's public IP address and port number. The term "combination address" is used herein to refer to the combination of an IP address and a port number.

[0012] Source device 110 sends a bind request to mediation element 112. This first bind request is a dummy bind request which is sent to a port that mediation element 112 is not going to respond to. In Figure 2, this dummy bind request is shown as going to port B1.

[0013] Source device 110 sends a second bind request to mediation element 112. This bind request is shown as being sent to port B2. The second bind request is not a dummy bind request. In response to the second bind request, mediation element 112 sends a bind response to source device 110. This bind response provides source device 110 with the public IP address and port information corresponding to how source device 110 appears to network 120. In other words, the bind response provided by mediation element 112 tells source device 110 its combination network address after possibly having been translated by NAT Gateway 130.

[0014] After receiving the bind response from mediation element 112, source device 110 sends a connection request to mediation element 112. This connection request contains the combination address information associated with source device 110. The connection request may also contain other information, such as information about all of source device 110's local IP addresses, WAN address information obtained from a bind response, and, the connection request contains information about mediation element 112's IP address which is used for mediation. LAN and WAN address information that may be useful in establishing connectivity with destination device 111. Mediation element 112 forwards this connection request to message server 113. The connection request forwarded to message server 113 also contains information about mediation element 112. Mediation element 112 and message server 113 are able to communicate with each other via network 120. Mediation element 112 and message server 113 typically have static or easily determined public combination addresses.

[0015] Message server 113 forwards the connection request to destination device 111. Message server 113 knows the correct combination address of where to send this connection request because it has been in persistent communication with destination device 111.

[0016] In response to the connection request, destina-

tion device 111 may open a new UDP socket and send a bind request to mediation element 112. This first bind request is a dummy bind request which is sent to a port that mediation element 112 is not going to respond to. Destination device 111 uses information received in the connection request to know where to address this bind request. Destination device 110 sends a second bind request to mediation element 112. The second bind request is not a dummy bind request.

[0017] In response to the second bind request, mediation element 112 sends a bind response to destination device 111. This bind response provides destination device 111 with the public IP address and port information corresponding to how destination device 111 appears to network 120. In other words, the bind response provided by mediation element 112 tells destination device 111 its combination network address after possibly having been translated by NAT Gateway 131.

[0018] After receiving a bind response from mediation element 112, destination device 111 sends a connection response to mediation element 112. This connection response contains the combination address information associated with destination device 111. The connection response may also contain other information, such as all IP addresses of all of destination device 111's local interfaces, WAN address information associated with destination device 111 that may be useful in establishing connectivity with source device 110, and the WAN IP address of source device 110. This connection response is forwarded to source device 110 by mediation element 112 which may extract source device 110's IP address from the connection response.

[0019] After sending the connection response, destination device 111 sends a series of hello messages. These hello messages may be sent to the addresses associated with source device 110 received in the connection request, and to a set of predicted combination addresses based on that address. For example, if a port number received in the connection request is S, destination device 111 may send hello messages to port S+1, S+2 ... S+N and S-1, S-2, ... S-N, where N is an arbitrary number such as 10. Other address prediction methods are possible.

[0020] For example, by sending multiple bind requests to different mediation elements, the received bind responses may be processed to determine patterns in IP addresses and port numbers. This pattern may be used to communicate more WAN combination addresses to source device 110. These additional combination addresses may be used by source device 110 to send additional hello messages. This may be particularly useful in covering scenarios where a NAT gateway 130-131 is using a pool of IP addresses or port numbers which have a difference that is greater than N.

[0021] In another example, other port/IP patterns may be determined and additional hello messages may be sent by source device 110 to combination addresses that fit the pattern. All of these hello messages may be sent

by destination device 111 from the same source port number. In addition, destination device 111 may send hello messages to one or more WAN IP addresses. Destination device 111 may send hello messages to one or more LAN addresses that were specified in the connection request.

[0022] At the same time, after receiving the connection response, source device 110 sends a series of hello messages. These hello messages may be sent to the address associated with destination device 111 received in the connection response, and to a set of predicted combination addresses based on that address. For example, if the port number received in the connection response is D, source device 110 may send hello messages to port D+1, D+2 ... D+Q and D-1, D-2 ... D-Q, where Q is an arbitrary number such as 10. Other address prediction methods, such as those described above with respect to destination device 111, are possible. All of these hello messages may be sent by source device 110 from the same source port number. In addition, source device 110 may send hello messages to one or more WAN IP addresses. Source device 110 may send hello messages to one or more LAN addresses that were specified in the connection response.

[0023] When destination device 111 receives a hello message from source device 110, it may obtain a "from source" combination address from the hello message. Destination device 111 may then send an acknowledgment message to this "from source" combination address. Likewise, when source device 110 receives hello message from destination device 111, it may obtain a "from destination" combination address from the hello message. Source device 110 may then send an acknowledgment message to this "from destination" combination address. Accordingly, when destination device 111 has both sent and received an acknowledgment message, it knows that a particular "from source" combination address can be used to send packets for source device 110. Likewise, when source device 110 has both sent and received an acknowledgment message, it knows that a particular "from destination" combination address can be used to send packets for destination device 111. When source device 110 or destination device 111 know a combination address that can be used to establish communication with the other device, they may stop sending hello messages to predicted port addresses. After both source device 110 and destination device 111 know combination addresses that can be used to establish communication with the other device, these devices establish data connection with each other using the predicted port addresses that were successful in reaching the other device.

[0024] Figure 3 is a flowchart of a source method of establishing a connection traversing at least one network address translation gateway. The steps illustrated in Figure 3 may be performed by one or more elements of NAT traversal system 100. A bind request is sent from a source device to a mediation element via an NAT gateway (302).

For example, source device 110 may send a bind request to mediation element 112.

[0025] A bind response including a first combination address is received (304). For example, source device 110 may receive a bind response from mediation element 112. This bind response may include a combination address associated with source device 110. This combination address may reflect the address that NAT Gateway 130 uses to represent source device 110 to network 120.

[0026] A connection request is sent to the mediation element (306). For example, source device 110 may send a connection request to mediation element 112. This connection request includes a combination address associated with source device 110 by NAT Gateway 130. As discussed previously, this connection request includes combination addresses or other information that may be used to help establish connectivity with destination device 111.

[0027] A connection response associated with the connection request is received (308). For example, source device 110 may receive a connection response sent by destination device 111. This connection response may have been relayed to source device 110 by mediation element 112. This connection response may include a combination address or other information associated with destination device 111 that may be used to help establish connectivity with destination device 111.

[0028] An hello message is sent to a predicted destination address (310). For example, if a port number received in the connection response is D, source device 110 may send hello messages to port D+1, D+2 ... D+Q, and D-1, D-2 ... D-Q, where Q is an arbitrary number such as 10. As discussed previously, other address prediction methods are possible. All of these hello messages may be sent by source device 110 from the same source port number.

[0029] A data connection is established between the source device and the destination device using the predicted combination address (312). For example, a data connection may be established between source device 110 and destination device 111. This data connection may be established as a result of source device 110 having received an acknowledgment message. This acknowledgement message may have been in response to a hello message source device 110 sent to a predicted combination address.

[0030] Figure 4 is a flowchart of a destination method of establishing a connection traversing at least one network address translation gateway. The steps illustrated in Figure 4 may be performed by one or more elements of NAT traversal system 100. A connection request relayed via a mediation element is received from a source device (402). For example, destination device 111 may receive a connection request from source device 110. This connection request may have been relayed by mediation element 112. This connection request includes a combination address associated with source device 110 by NAT Gateway 130. This connection request includes

a combination address associated with mediation element 112. As discussed previously, this connection request made include other information that may be used to help establish connectivity with destination device 111.

[0031] A bind request is sent to the mediation element (404). For example, destination device 111 may send a bind request to mediation element 112. A bind response from the mediation element is received (406). For example, destination device 111 may receive, in response to the bind request sent in block 404, a bind response from mediation element 112. This bind response includes a combination address associated with destination device 111. This combination address may reflect the address that NAT Gateway 131 uses to represent destination device 110 to network 120.

[0032] A connection response is sent (408). For example, destination device 111 may send a connection response to mediation element 112. Mediation element 112 may relay this connection response to source device 110. As discussed previously, this connection response may include combination addresses or other information associated with destination device 111 that may be used by source device 110 to help establish connectivity with destination device 111.

[0033] An hello message is sent to a predicted source address (410). For example, if a port number received in the connection request is S, destination device 111 may send hello messages to port S+1, S+2 ... S+N, and S-1, S-2 ... S-N where N is an arbitrary number such as 10. As discussed previously, other address prediction methods are possible. All of these hello messages may be sent by destination device 111 from the same source port number.

[0034] A data connection between the source device and the destination device is established using a predicted source address (412). For example, a data connection may be established between source device 110 and destination device 111. This data connection may be established as a result of destination device 111 having received an acknowledgment message. This acknowledgment message may have been in response to a hello message destination device 111 sent to a predicted combination address.

[0035] Figure 5 is a flowchart of a mediation element method of establishing a connection traversing at least one network address translation gateway. The steps illustrated in Figure 5 may be performed by one or more elements of NAT traversal system 100. A source bind request is received from a source device via an NAT gateway (502). For example, mediation element 112 may receive a bind request from source device 110. This bind request may have been sent via NAT gateway 130.

[0036] A source bind response is sent to the source device (504). For example, mediation element 112 may send, to source device 110, a response to the bind request received in block 502. This bind response includes a combination address associated with source device 110. This combination address may reflect the address

that NAT Gateway 130 uses to represent source device 110 to network 120. This source bind response may include other combination addresses. For example, this source bind response may include suggested or predicted combination addresses that mediation element 112 determines may be good choices as predicted combination addresses.

[0037] A connection request is received from the source device (506). For example, mediation element 112 may receive a connection request from source device 110. This connection request may include a combination address associated with source device 110 by NAT Gateway 130. As discussed previously, this connection request made include other information that may be used to help establish connectivity with destination device 111.

[0038] The connection request is relayed to a message server for relay to a destination device (508). For example, mediation element 112 may relay the connection request received in block 506 to message server 113 for relay to the destination device 111. This connection request includes information about mediation element 112, such as a combination address for mediation element 112. A destination bind request is received from the destination device (510). For example, mediation element 112 may receive a bind request from destination device 111. This bind request may have been sent via NAT gateway 131.

[0039] A destination bind response is sent to the destination device (512). For example, mediation element 112 may send, to destination device 111, a response to the bind request received in block 510. This bind response may include a combination address associated with destination device 111. This combination address may reflect the address that NAT Gateway 131 uses to represent destination device 111 to network 120. This bind response may include other combination addresses. For example, this destination bind response may include suggested or predicted combination addresses that mediation element 112 determines may be good choices as predicted combination addresses.

[0040] A connection response is received from the destination device (514). For example, mediation element 112 may receive a connection response from destination device 111. This connection response may include a combination address or other information associated with destination device 111 that may be used by source device 110 to help establish connectivity with destination device 111. The connection response is relayed to the source device (516). For example, mediation element 112 may relay the connection response to source device 110. As discussed previously, the connection response may also contain combination addresses or other information that may be useful in establishing connectivity with source device 110. The connection response may also contain information about mediation element 112.

[0041] The methods, systems, devices, elements, networks, routers, and gateways described above may be

implemented with, contain, or be executed by one or more computer systems. The methods described above may also be stored on a computer readable medium. Many of the elements of NAT traversal system 100 may be, comprise, or include computers systems. This includes, but is not limited to: source device 110, destination device 111, mediation element 112, message server 113, network 120, NAT gateway 130, and NAT gateway 131.

[0042] Figure 6 illustrates a block diagram of a computer system. Computer system 600 includes communication interface 620, processing system 630, and user interface 660. Processing system 630 includes storage system 640. Storage system 640 stores software 650. Processing system 630 is linked to communication interface 620 and user interface 660. Computer system 600 could be comprised of a programmed general-purpose computer, although those skilled in the art will appreciate that programmable or special purpose circuitry and equipment may be used. Computer system 600 may be distributed among multiple devices that together comprise elements 620-660.

[0043] Communication interface 620 could comprise a network interface, modem, port, transceiver, or some other communication device. Communication interface 620 may be distributed among multiple communication devices. Processing system 630 could comprise a computer microprocessor, logic circuit, or some other processing device. Processing system 630 may be distributed among multiple processing devices. User interface 660 could comprise a keyboard, mouse, voice recognition interface, microphone and speakers, graphical display, touch screen, or some other type of user device. User interface 660 may be distributed among multiple user devices. Storage system 640 may comprise a disk, tape, integrated circuit, server, or some other memory device. Storage system 640 may be distributed among multiple memory devices.

[0044] Processing system 630 retrieves and executes software 650 from storage system 640. Software 650 may comprise an operating system, utilities, drivers, networking software, and other software typically loaded onto a computer system. Software 650 may comprise an application program, firmware, or some other form of machine-readable processing instructions. When executed by processing system 630, software 650 directs processing system 630 to operate as described herein.

[0045] It will be appreciated that modifications in, or variations of, the embodiments as described and illustrated may be made within the scope of the accompanying claims. For example, other algorithms and information may be used to create predicted combination addresses. In addition, different aspects of embodiments as disclosed herein may be combined to create further implementations.

Claims

1. A method of establishing a connection traversing at least one network address translation, NAT, gateway (130,131), the method comprising:

sending (302) a bind request from a source device (110) to a first element (112) via a NAT gateway (130);

receiving (304) at the source device (110) a bind response including a source combination address that is the public address of the source device, the source combination address comprising a combination of an IP address and a port number;

establishing a connection request at the source device (110) and including the source combination address, and causing the connection request to be sent from the source device to a destination device (111) via at least one NAT gateway (130,131) and via the first element (112);

receiving (308) at the source device (110) a connection response sent by the destination device (111) and including a destination combination address that is the public address of the destination device, the destination combination address comprising a combination of an IP address and a port number;

sending (310) a hello message to a predicted destination combination address based on the destination combination address received; and establishing (312) a data connection between the source device (110) and the destination device (111) using the predicted destination combination address; wherein the connection request is sent to a destination device (111) via the first element (112) and via a message server (113);

and in that the message server (113) maintains a persistent connection with the destination device (111) so that the message server (113) was in communication with the destination device (111) prior to the bind request from the source device (110) wherein the connection request sent from the source device also includes the IP address of the first element (112) so that, in response to the connection request, the destination device (111) is enabled to send a bind request to said first element (112); and

in that after receiving a bind response from the first element (112), destination device (111) sends said connection response to the first element (112) which contains said destination combination address of the destination device (111).

2. A method as claimed in Claim 1, wherein the data connection is established on receiving an acknowl-

edgement message as a result of sending said message to the predicted destination address.

3. A method as claimed in Claim 1 or Claim 2, further comprising:

selecting a plurality of predicted combination addresses using a range of port numbers around a first port number included in the source or the destination combination address; and,
sending hello messages to each of the predicted combination addresses.

4. A method as claimed in any preceding claim, further comprising:

when a connection request associated with the source device (506) is established, and has been sent to the destination device (508) via the first element (112),
receiving (510) at the source device (506) a destination bind request from the destination device (508);
sending (512) a destination bind response to the destination device (508), the destination bind response including the destination combination address associated with the destination device;
receiving (514) from the destination device (508) the connection response; and,
relaying the connection response to the source device (506) via the first element (112).

5. A method as claimed in Claim 4, further comprising sending a dummy bind request from the source device.

6. A method as claimed in Claim 4 or Claim 5, further comprising sending a predicted source combination address to the destination device (508).

7. A method as claimed in any of Claims 4 to 6, further comprising sending a predicted destination combination address to the source device (506).

Patentansprüche

1. Verfahren zum Erstellen einer Verbindung, die mindestens ein Gateway zur Netzwerkadressübersetzung NAT (130, 131) durchläuft, wobei das Verfahren aufweist:

Senden (302) einer Bindeanforderung von einem Quellgerät (110) an ein erstes Element (112) über ein NAT-Gateway (130);
Empfangen (304) einer Bindeantwort an dem Quellgerät (110), die eine Quellenkombinationsadresse enthält, welche die öffentliche

Adresse des Quellgeräts ist; wobei die Quellenkombinationsadresse eine Kombination einer IP-Adresse und einer Portnummer aufweist;
Erstellen einer Verbindungsanforderung an dem Quellgerät (110) und Aufnehmen der Quellenkombinationsadresse und Veranlassen, dass die Verbindungsanforderung über mindestens ein NAT-Gateway (130, 131) und über das erste Element (112) von dem Quellgerät an ein Zielgerät (111) gesendet wird;
Empfangen (308) einer Verbindungsantwort an dem Quellgerät (110), die von dem Zielgerät (111) gesendet wurde und eine Zielkombinationsadresse enthält, welche die öffentliche Adresse des Zielgeräts ist; wobei die Zielkombinationsadresse eine Kombination einer IP-Adresse und einer Portnummer aufweist;
Senden (310) einer Hello-Nachricht an eine vorhergesagte Zielkombinationsadresse auf Grundlage der empfangenen Zielkombinationsadresse; und
Erstellen (312) einer Datenverbindung zwischen dem Quellgerät (110) und dem Zielgerät (111) unter Verwendung der vorhergesagten Zielkombinationsadresse; wobei die Verbindungsanforderung über das erste Element (112) und über einen Nachrichtenserver (113) an ein Zielgerät (111) gesendet wird; und wobei der Nachrichtenserver (113) eine dauernde Verbindung mit dem Zielgerät (111) aufrechterhält, sodass sich der Nachrichtenserver (113) mit dem Zielgerät (111) vor der Bindeanforderung von dem Quellgerät (110) in Kommunikation befand, wobei die von dem Quellgerät gesendete Verbindungsanforderung auch die IP-Adresse des ersten Elements (112) enthält, sodass in Reaktion auf die Verbindungsanforderung dem Zielgerät (111) ermöglicht wird, eine Bindeanforderung an das erste Element (112) zu senden; und wobei nach einem Empfangen einer Bindeantwort von dem ersten Element (112) das Zielgerät (111) die Verbindungsantwort an das erste Element (112) sendet, das die Zielkombinationsadresse des Zielgeräts (111) enthält.

2. Verfahren nach Anspruch 1, wobei die Datenverbindung bei Empfang einer Bestätigungsnachricht erstellt wird als Ergebnis des Sendens der Nachricht an die vorhergesagte Zieladresse.

3. Verfahren nach Anspruch 1 oder Anspruch 2, ferner aufweisend:

Auswählen einer Mehrzahl von vorhergesagten Kombinationsadressen unter Verwendung eines Bereichs von Portnummern um eine erste Portnummer, die in der Quellen- oder der Ziel-

kombinationsadresse enthalten ist; und
Senden von Hello-Nachrichten an jede der vorhergesagten Kombinationsadressen.

4. Verfahren nach einem der vorhergehenden Ansprüche, ferner aufweisend: 5
wenn eine dem Quellgerät (506) zugehörige Verbindungsanforderung erstellt und über das erste Element (112) an das Zielgerät (508) gesendet wurde, 10
Empfangen (510) einer Zielbindeanforderung von dem Zielgerät (508) an dem Quellgerät (506);
Senden (512) einer Zielbindeantwort an das Zielgerät (508), wobei die Zielbindeantwort die dem Zielgerät zugehörige Zielkombinationsadresse enthält; 15
Empfangen (514) der Verbindungsantwort von dem Zielgerät (508); und 20
Weiterleiten der Verbindungsantwort an das Quellgerät (506) über das erste Element (112).
5. Verfahren nach Anspruch 4, ferner aufweisend ein Senden einer Dummy-Bindeanforderung von dem Quellgerät. 25
6. Verfahren nach Anspruch 4 oder Anspruch 5, ferner aufweisend ein Senden einer vorhergesagten Quellenkombinationsadresse an das Zielgerät (508). 30
7. Verfahren nach einem der Ansprüche 4 bis 6, ferner aufweisend ein Senden einer vorhergesagten Zielkombinationsadresse an das Quellgerät (506). 35

Revendications

1. Méthode d'établissement d'une connexion parcourant au moins une passerelle de traduction d'adresse réseau, NAT, (130,131), la méthode comprenant : 40
l'envoi (302) d'une requête de chaînage d'un dispositif source (110) à un premier élément (112) à travers une passerelle NAT (130) ; 45
la réception (304) du dispositif source (110) d'une réponse de chaînage comprenant une adresse combinée source, qui est l'adresse publique du dispositif source, l'adresse combinée source comprenant une combinaison d'une 50
adresse IP et un numéro de port ;
l'établissement d'une demande de connexion au dispositif source (110), comprenant l'adresse combinée source, et déterminant l'envoi de la demande de connexion du dispositif source à un dispositif destinataire (111) par le biais d'au moins une passerelle NAT (130,131) et du premier élément (112) ; 55
2. Méthode selon la revendication 1, la connexion de données étant établie à la réception d'un message d'acquiescement à la suite de l'envoi dudit message à l'adresse de destination prévue.
3. Méthode selon la revendication 1 ou la revendication 2, comprenant en outre :
la sélection d'une pluralité d'adresses combinées prévues en utilisant une gamme de numéros de port autour d'un premier port compris dans l'adresse combinée source ou de destination ; et
l'envoi de messages d'accueil à chacune des adresses combinées prévues.
4. Méthode selon une quelconque des revendications précédentes, comprenant en outre :

la réception (308) au dispositif source (110) d'une réponse de connexion envoyée par le dispositif destinataire (111) et comprenant une adresse combinée de destination, qui est l'adresse publique du dispositif destinataire, l'adresse combinée de destination comprenant une combinaison d'une adresse IP et d'un numéro de port ;
l'envoi (310) d'un message d'accueil à une adresse combinée de destination prévue, basée sur l'adresse combinée de destination reçue ; et
l'établissement (312) d'une connexion de données entre le dispositif source (110) et le dispositif destinataire (111) utilisant l'adresse combinée de destination prévue ;
la demande de connexion étant transmise à un dispositif destinataire (111) via le premier élément (112) et via un serveur de messages (113) ;
et le serveur de messages (113) maintenant une connexion persistante avec le dispositif destinataire (111) de sorte que le serveur de messages (113) soit en communication avec le dispositif destinataire (111) préalablement à la requête de chaînage provenant du dispositif source (110), la demande de connexion envoyée du dispositif source comprenant également l'adresse IP du premier élément (112) de sorte qu'en réponse à la demande de connexion, le dispositif destinataire (111) soit activé pour envoyer une requête de chaînage audit premier élément (112) ; et
après la réception d'une réponse de chaînage du premier élément (112), le dispositif destinataire (111) envoyant ladite réponse de connexion au premier élément (112), qui contient ladite adresse combinée de destination du dispositif destinataire (111).

lors de l'établissement d'une demande de connexion associée avec le dispositif source (506), et de son envoi au dispositif destinataire (508) par le biais du premier élément (112), la réception (510) au dispositif source (506) d'une requête de chaînage de destination provenant du dispositif destinataire (508) ;
 l'envoi (512) d'une réponse de chaînage de destination au dispositif destinataire (508), la réponse de chaînage de destination comprenant l'adresse combinée de destination associée avec le dispositif destinataire ;
 la réception (514), du dispositif destinataire (508), de la réponse de connexion ; et
 la retransmission de la réponse de connexion au dispositif source (506) par le biais du premier élément (112).

5. Méthode selon la revendication 4, comprenant en outre l'envoi d'une requête de chaînage fictive par le dispositif source.
6. Méthode selon la revendication 4 ou la revendication 5, comprenant en outre l'envoi d'une adresse combinée source prévue au dispositif destinataire (508).
7. Méthode selon une quelconque des revendications 4 à 6, comprenant en outre l'envoi d'une adresse combinée de destination prévue au dispositif source (506).

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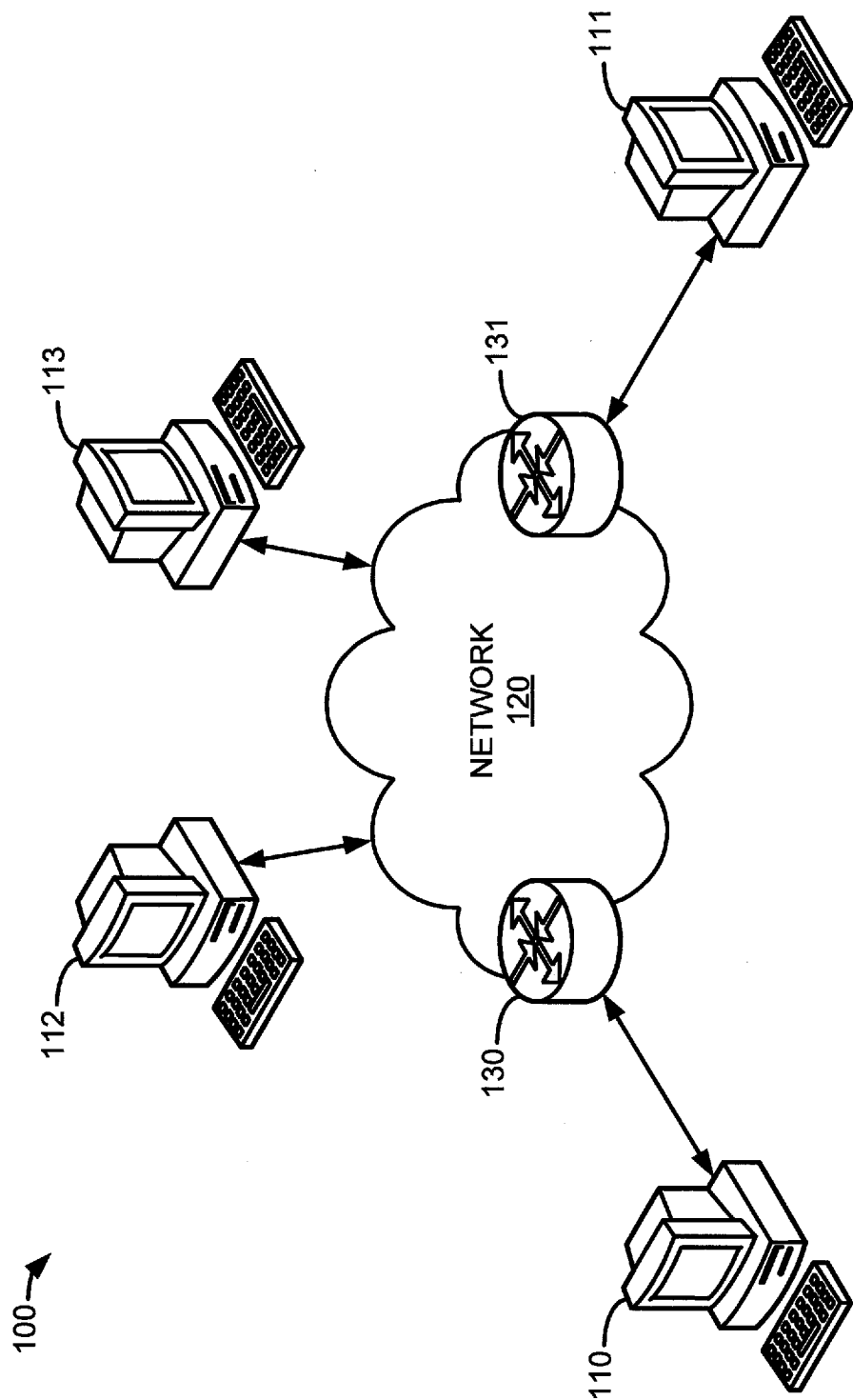


FIGURE 1

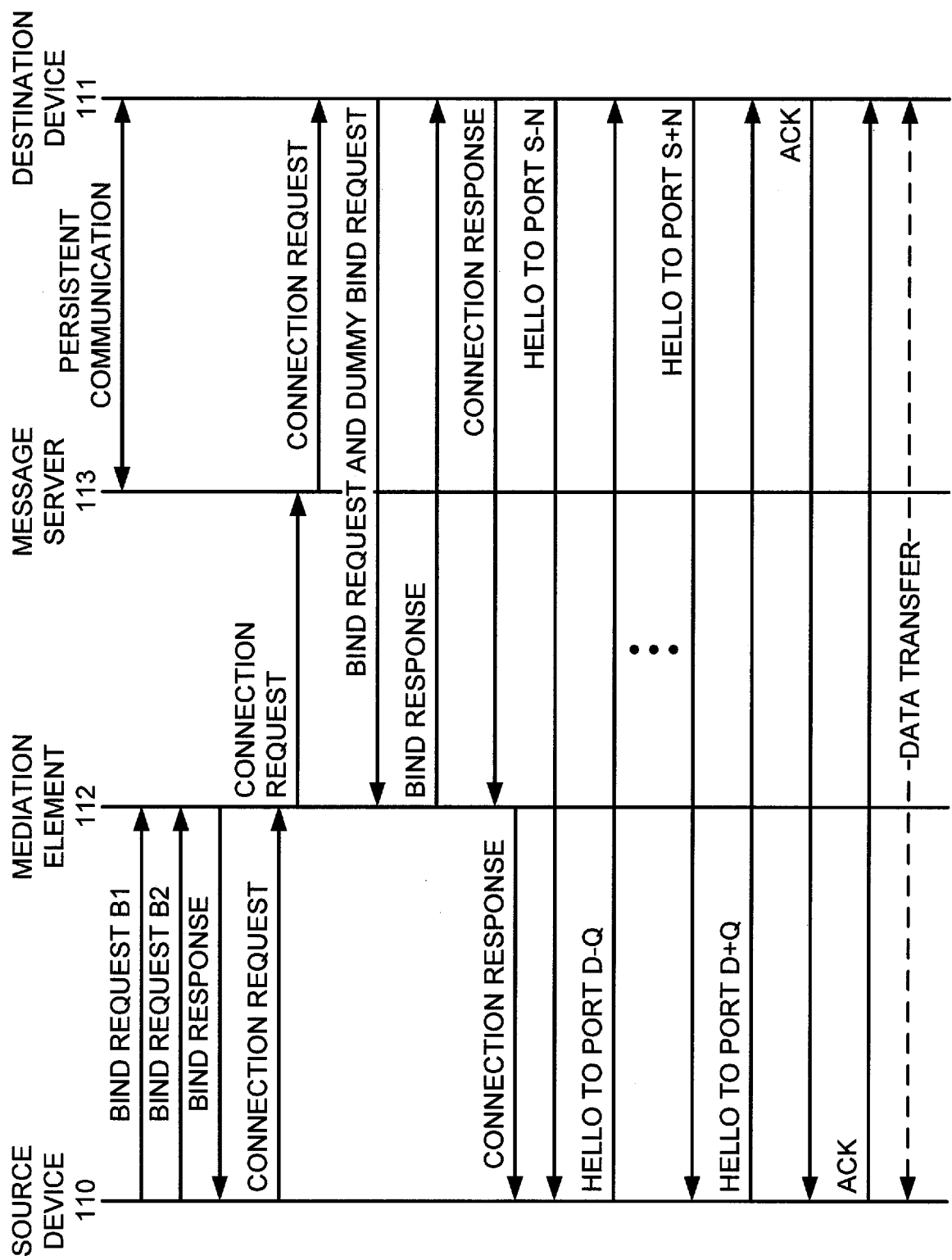


FIGURE 2

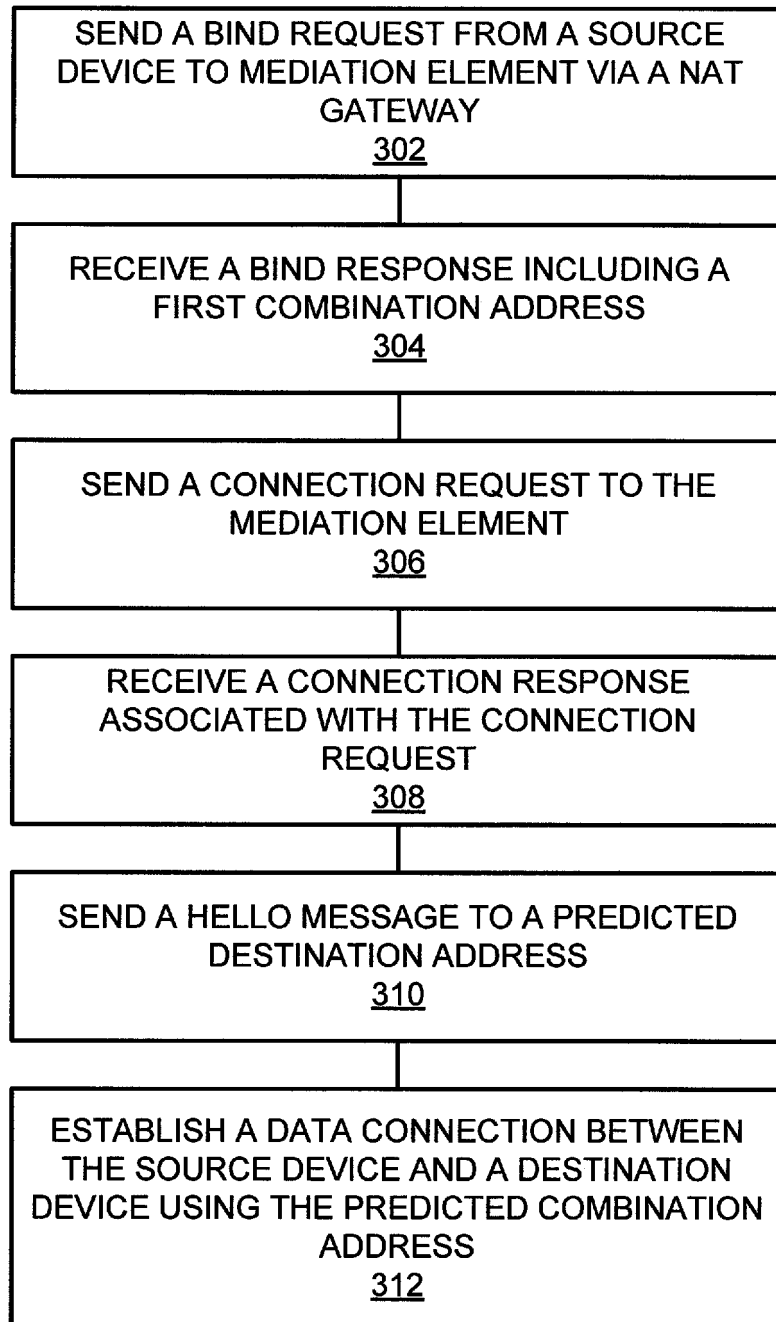


FIGURE 3

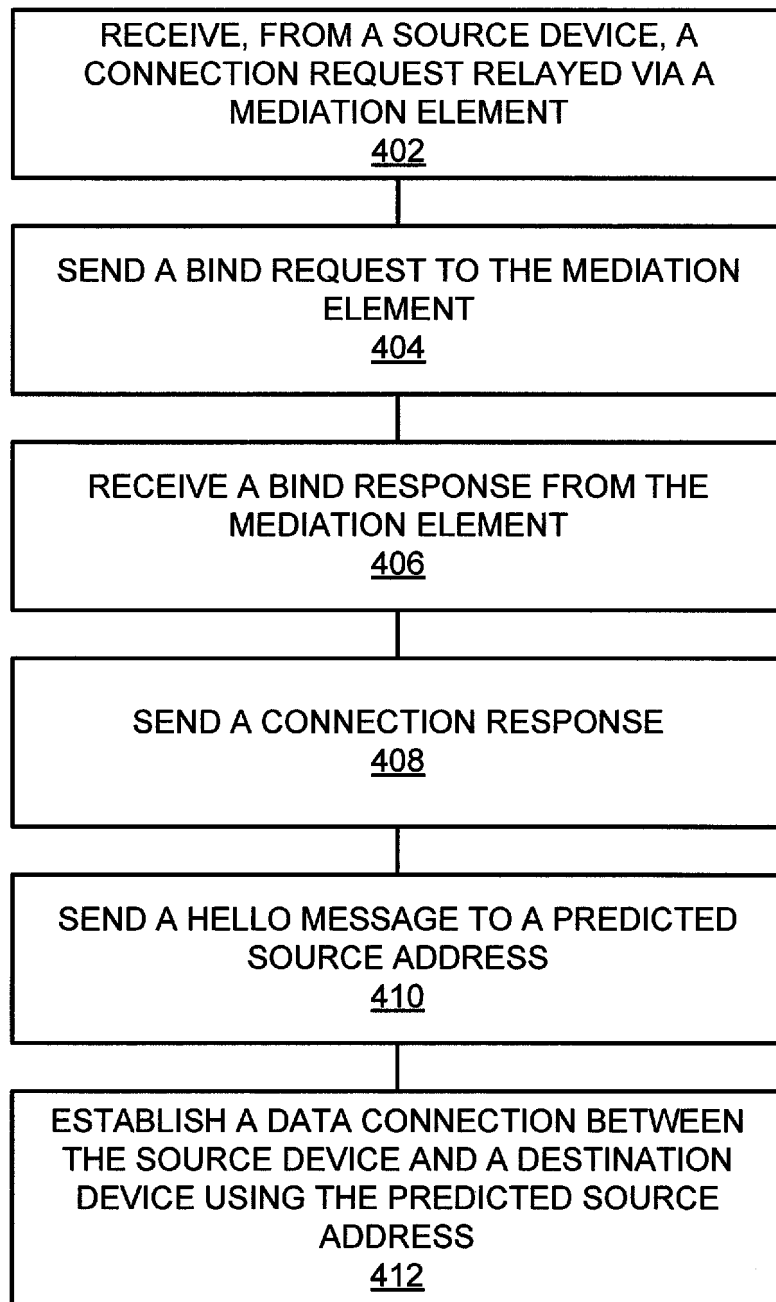


FIGURE 4

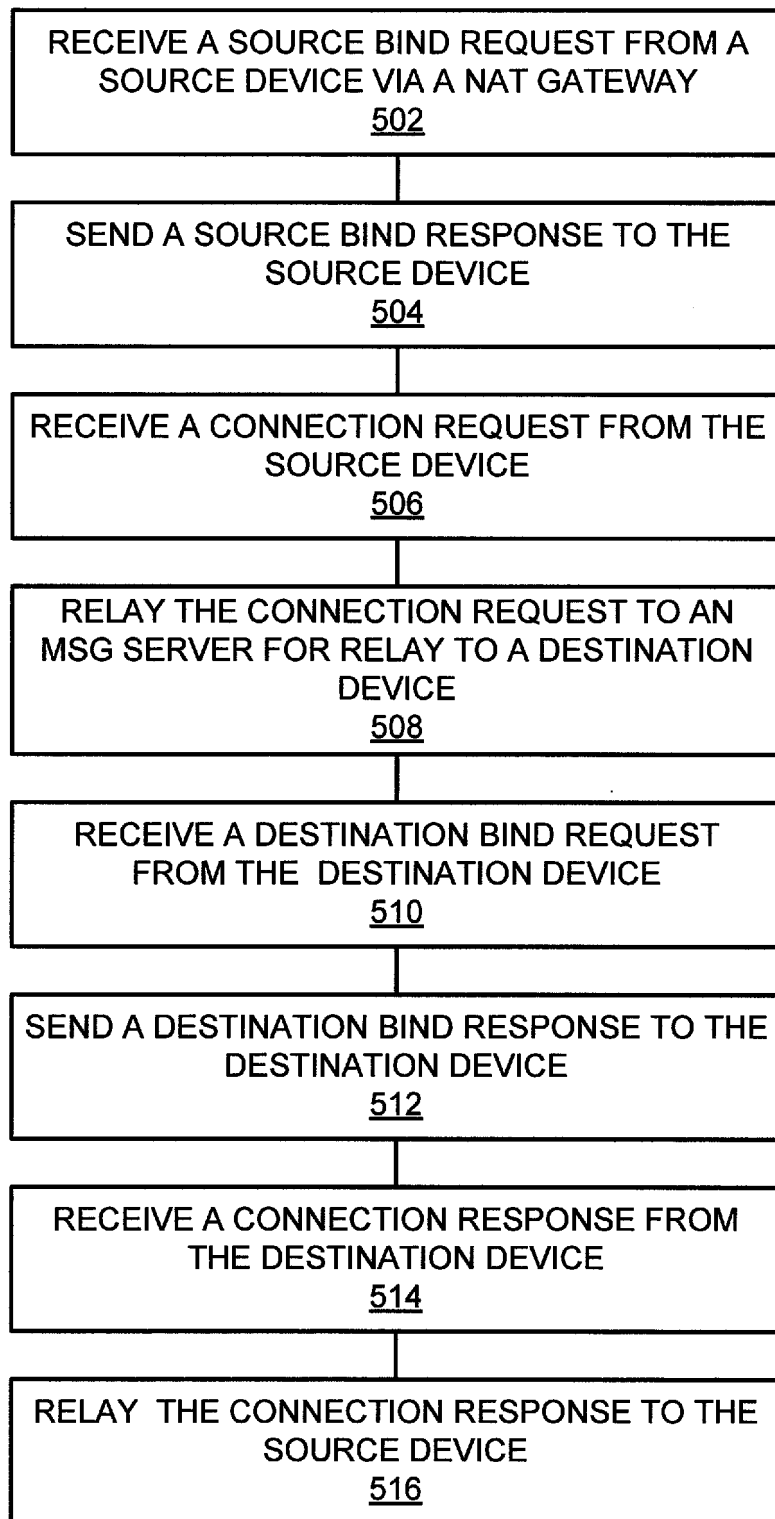


FIGURE 5

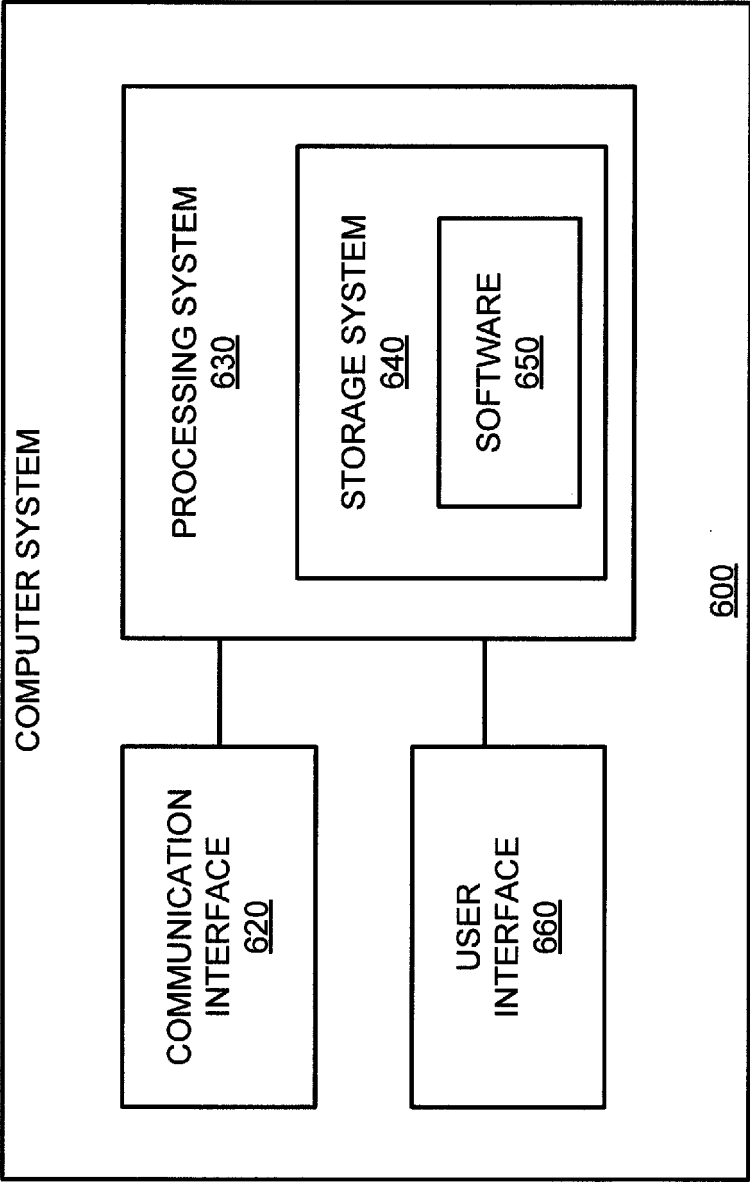


FIGURE 6

REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- **BOULTON et al.** Best Current Practices for NAT Traversal for SIP. IETF, 09 July 2007 **[0004]**
- **ROSENBERG.** Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/ Answer Protocols. IETF, 29 October 2007 **[0005]**